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10/773,187	02/09/2004	Kia Silverbrook	MTB31US	8432

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EXAMINER	
FIDLER, SHELBY LEE	

ART UNIT	PAPER NUMBER
2861	

DATE MAILED: 11/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/773,187	SILVERBROOK, KIA	
	Examiner	Art Unit	
	Shelby Fidler	2861	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 September 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-19,21-38 and 40-54* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-19,21-38 and 40-54* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *09 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *10/20/2006*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

Claims 1, 9, 11, 18, 28, 30, and 38 are objected to because of the following informalities:

Regarding claims 1, 18, and 38: the claims contain the phrase "from eachother" (e.g. line 12 of claim 1). Regarding claims 9 and 28: the claims contain the phrase "a said drop." Please change to "said drop." Regarding claims 11 and 30: the claims contain the phrase "a said bubble." Please change to "said bubble." Appropriate correction is required.

Claims 9 and 28 recite the limitation "said part" in line 3. There is insufficient antecedent basis for this limitation in the claim. For the purpose of examination, Examiner assumes that "said part" refers to the heater element.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 5, 11-13, 19, 24, 30-32, 38, 42, 47, 48, and 50 are rejected under 35 U.S.C. 102(b) as being anticipated by Campbell et al. (US 4870433).

Regarding claims 1, 19, and 38:

Campbell et al. disclose an inkjet printhead comprising:

a plurality of nozzles (nozzles 19; col. 3, lines 1-3 and col. 2, lines 17-21) each has a nozzle aperture (Fig. 2);

a bubble forming chamber (print cavity 21) corresponding to each of the nozzles respectively (Fig. 2);

a heater element (resistive heater elements 12) disposed in each of the bubble forming chambers respectively (Fig. 2), the heater element having two bubble nucleation regions (elongated portions 31) laterally offset from a central axis of the nozzle aperture (Fig. 3), the lateral offset of one of the bubble nucleation regions being equal and opposite to the lateral offset of the other bubble nucleation region (Figs. 1-3); such that

heating the heater element to a temperature above the boiling point of the bubble forming liquid forms a gas bubble (bubble 22) that causes the ejection of a drop of an ejectable liquid through the nozzle aperture corresponding to that heater element (col. 3, lines 8-13); wherein

the bubble nucleation regions are spaced from each other such that bubbles nucleated at each will grow until they unite to form the gas bubble that causes the ejection of a drop of ejectable liquid (col. 3, lines 50-60); and

supplying the nozzle with a replacement volume of the ejectable liquid equivalent to the ejected drop (obvious to the cyclic ejections of col. 3, lines 3-7 and col. 4, lines 64-68).

Regarding claims 5, 24, and 42:

Campbell et al. also disclose that the bubble forming liquid and the ejectable liquid are of a common body of liquid (col. 3, lines 8-13).

Regarding claims 11, 30, and 47:

Campbell et al. also disclose that each heater element (12) has two opposite sides (top curved portion and bottom curved portion of heater element 12 in Fig. 3) and is configured such that the gas bubble (22) formed by that heater element is formed at both sides of that heater element (col. 3, lines 50-60).

Regarding claims 12, 31, and 48:

Campbell et al. also disclose that the bubble (20), which each heater element is configured to form, is collapsible and has a point of collapse, and wherein each heater element is configured such that the point of collapse of a bubble formed thereby is spaced from that heater element (col. 3, lines 60-66).

Regarding claims 13, 32, and 50:

Campbell et al. also disclose a structure (substrate 18), wherein the nozzles (19) are incorporated on the structure (col. 3, lines 1-3 and Fig. 2).

Examiner notes the limitation that the structure is formed by chemical vapor deposition. However, this limitation pertains only to the method of forming a device, which is not germane to the patentability of the device itself; therefore, Examiner has not given this limitation patentable weight.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 3, 21, and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. in view of Gerber et al. (US6680668 B2).

Regarding claims 3, 21, and 40:

Campbell et al. disclose all the limitations of claim 1 as well as the limitation that the heater element has two parallel spans (top curved portion and bottom curved portion of heater element 12 in Fig. 3; col. 4, lines 20-23) disposed on either side of a nozzle aperture axis (Figs. 1-3), such that each of the spans has one of the bubble nucleation regions (Fig. 3).

Campbell et al. do not expressly disclose that the heater element is a suspended beam.

However, Gerber et al. disclose a heater element (foil trace 12) that is a suspended beam (col. 4, lines 31-32 and Fig. 8).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to modify the heater element of Campbell et al. to be in the form of a suspended beam. The motivation for doing so, as taught by Gerber et al., is so that the heater element will quickly increase in temperature since the heat is not absorbed by the substrate (col. 4, lines 32-38).

Claims 4, 7, 15, 16, 18, 22, 26, 34, 35, 37, 41, 51, 52, and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. in view of Anagnostopoulos et al. (US 6502925 B2).

Regarding claims 4, 7, 22, 26, and 41:

Campbell et al. disclose all claimed limitations except that the heater elements are formed predominantly from titanium nitride.

However, Anagnostopoulos et al. disclose heater elements (notch type heaters) formed predominantly from titanium nitride (col. 10, lines 32-34).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to modify the heater elements of Campbell et al. to be predominantly titanium nitride. The motivation for doing so, as taught by Chan (US 5710070), is that the titanium/titanium nitride resistive layer provides good electro-migration performance to sustain high current density at high temperatures (col. 3, lines 30-33).

Regarding claims 15, 34, and 51:

Campbell et al. disclose all claimed limitations except a plurality of heater elements disposed within each bubble forming chamber, the heater elements within each chamber being formed on different respective layers to one another.

However, Anagnostopoulos et al. disclose a plurality of the heater elements (notch type heaters) disposed within a bubble forming chamber (col. 8, lines 36-37), the heater elements within each chamber being formed on different respective layers to one another (col. 8, lines 36-38).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a plurality of heater elements in each bubble forming chamber into the invention of Campbell et al. The motivation for doing so, as taught by Anagnostopoulos et al., is to provide two heaters able to fire simultaneously or at different times (col. 8, lines 42-47).

Regarding claims 16, 35, and 52:

Campbell et al. disclose all claimed limitations except that the heater elements are formed of solid material more than 90% of which is constituted by at least one periodic element having an atomic number below 50.

However, Anagnostopoulos et al. disclose heater elements formed of solid material more than 90% of which is constituted by at least one periodic element, having an atomic number below 50 (Ti and TiN, col. 10, lines 31-33).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize heater elements formed of Titanium and Titanium Nitride into the invention of Campbell et al. The motivation for doing so, as taught by Chan (US 5710070), is that the titanium/titanium nitride resistive layer provides good electro-migration performance to sustain high current density at high temperatures (col.3, lines 30-33).

Regarding claims 18, 37, and 54:

Campbell et al. disclose all claimed limitations except that the heater elements have a conformal protective coating on any parts exposed to the bubble forming liquid, wherein the coating of each heater element is applied substantially to all sides of the heater element such that the coating is seamless (col. 10, lines 33-39 in combination with Figure 5).

Anagnostopoulos et al. disclose heater elements have a conformal protective coating (passivation layer) on any parts exposed to the bubble forming liquid, wherein the coating of each heater element is applied substantially to all sides of the heater element such that the coating is seamless (col. 10, lines 33-39 and Figs. 5 and 15).

Examiner notes the additional limitation that the protective coating is applied simultaneously. However, this limitation pertains only to the method of forming a device, which is not germane to the patentability of the device itself; therefore, Examiner has not given this limitation patentable weight.

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a protective coating applied substantially to all sides of the heater element into the

invention of Campbell et al. The motivation for doing so, as taught by Anagnostopoulos et al., is to protect the heater from the corrosive action of the ink (col. 10, lines 35-37).

Claims 6, 8, 10, 14, 25, 27, 29, 33, 43, 44, 46, and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. in view of Silverbrook (US 6019457).

Regarding claims 6, 25, and 43:

Campbell et al. disclose all claimed limitations except that the printhead is a page-width printhead.

However, Silverbrook discloses a pagewidth printhead (head 200) configured to print on a page (col. 6, lines 7-12).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a pagewidth printhead into the invention of Campbell et al. The motivation for doing so, as taught by Silverbrook, is to be able to print on the width of an A4 page (col. 6, lines 7-12).

Regarding claims 8, 27, and 44:

Campbell et al. disclose all claimed limitations except that the heater elements are configured such that an actuation energy of less than 500 nJ is required to heat the heater element sufficiently to form the bubble in the bubble forming liquid, thereby causing an ejection of the drop.

However, Silverbrook discloses heater elements (heaters 120; Fig. 10) that are configured such that an actuation energy of less than 500 nJ is required to heat the heater element sufficiently to form the bubble in the bubble forming liquid, thereby causing an ejection of the drop (200 nJ; col. 19, lines 8-9).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize heater elements that require less than 500 nJ to heat the heater element to eject a drop into the invention of Campbell et al. The motivation for doing so, as taught by Silverbrook, is to allow power dissipation to be reduced without affecting print speed (col. 19, lines 9-10).

Regarding claims 10, 29, and 46:

Campbell et al. disclose all claimed limitations except that the substrate surface has an areal density of nozzles exceeding 10,000 nozzles per square centimeter of substrate surface.

However, Silverbrook discloses a substrate surface wherein the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square centimeter of substrate surface (using the reference measurement of Figure 43 and counting the individual nozzles disclosed in the "part of cyan" section of Figure 43, calculations show that the density exceeds 10,000 per square centimeter: $\frac{20 nozzles}{0.0016384 cm^2} = 12207 \frac{nozzles}{cm^2}$).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a printhead substrate surface with a nozzle density of 10,000 nozzles per square centimeter into the invention of Campbell et al. The motivation for doing so, as taught by Silverbrook, is to provide four nozzles per pixel which would give up to 16 drops per pixel (co. 16, lines 60-62).

Regarding claims 14, 33, and 49:

Campbell et al. disclose all the limitations of claim 1 as well as the limitation that the printhead has a structure (substrate 18), wherein the nozzles (19) are incorporated on the structure (col. 3, lines 1-3 and Fig. 2).

Campbell et al. do not expressly disclose that the structure is less than 10 microns thick.

However, Silverbrook discloses a structure (overcoat 142) that is less than 10 microns thick (col. 9, lines 8-10), wherein nozzles are incorporated on the structure (Fig. 11).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a structure incorporating nozzles that is less than 10 microns thick into the invention of Campbell et al. The motivation for doing so, as taught by Silverbrook, is to provide increased levels of protection against the air (col. 9, lines 5-8).

Claims 9, 28, and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. in view of Hara et al. (US 4376945).

Regarding claims 9, 28, and 45:

Campbell et al. disclose all claimed limitations except that the printhead is configured to receive a supply of the ejectable liquid at an ambient temperature, wherein each heater element is configured such that the energy required to be applied to heat the heater element to cause the ejection of the drop is less than the energy required to heat a volume of the ejectable liquid equal to the volume of the drop, from a temperature equal to the ambient temperature to the boiling point.

However, Hara et al. disclose a printhead (recording heat 109) configured to receive a supply of the ejectable liquid (ink 114) at an ambient temperature (room temperature), wherein the heater elements are configured such that the energy required to be applied to heat the heater elements to cause the ejection of the drop is less than the energy required to heat a volume of the ejectable liquid equal to the volume of the drop, from a temperature equal to the ambient temperature to the boiling point (col. 31, lines 19-21, 26-29; preheating means keeps the

temperature in the chamber only 2-3 degrees below boiling, thus requiring less energy to eject a droplet).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize preheating means into the invention of Campbell et al. The motivation for doing so, as taught by Hara et al., is so that the heat energy of a recording signal effectively serves to form ink droplets and to improve energy efficiency (col. 30, lines 12-17).

Claims 17, 36, and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. in view of DeMoor et al.

Regarding claims 17, 36, and 53:

Campbell et al. disclose all claimed limitations except that the heater elements are configured for a mass of less than 10 nanograms to be heated to cause ejection of a drop.

However, DeMoor et al. disclose heater elements configured for a mass of less than 10 nanograms to be heated (page 285, Fabrication: Ti thickness = 5nm; TiN thickness = 30nm; heater width = 2000μm; heater width = 0.4μm. Therefore, the volume of Ti within the heater is $4*10^{-12}$ cm^3, and the volume of TiN within the heater is $2.4*10^{-11}$ cm^3. Using the known densities of Ti = 4.54 g/cm^3 and TiN = 5.22 g/cm^3, the heater element has an entire mass of 0.14344 ng).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize De Moor et al.'s heater element mass into the invention of Silverbrook as modified by Campbell et al. The motivation for doing so, as taught by De Moor et al., is that these types of heaters show excellent resistivity uniformity and a low TCR value (page 293, Conclusions).

Response to Arguments

Applicant's arguments with respect to claims 1, 19, and 38 have been considered but are moot in view of the new ground(s) of rejection. Please see the above rejection to Campbell et al.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shelby Fidler whose telephone number is (571) 272-8455. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Meier can be reached on (571) 272-2149. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

11/2/06

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